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The Power of Monthly Data in the GSOEP –
How the Chernobyl Catastrophe Affected People's Life Satisfaction and Environmental Concerns –

Berlin, December 2007

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The Power of Monthly Data in the GSOEP – How the Chernobyl Catastrophe Affected People's Life Satisfaction and Environmental Concerns

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Keywords: Subjective well-being, happiness, Environmental protection, household panel, SOEP

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1. Introduction

The German Socio-Economic Panel (GSOEP) is an annual household panel study that started its first wave in 1984 with a representative sample of the German population. The large sample size and the fact that the interviews for one wave are spread over a period of several months, with the information on the exact date of each interview being provided in the dataset, allows researchers to analyze abrupt events such as environmental catastrophes using just a single cross-section.

The purpose of this paper is to demonstrate by the analytical power of the GSOEP study with respect to its monthly data collection feature. As an example, I analyze the impact of the nuclear incident in Chernobyl on April 26, 1986, on life satisfaction and on people's worries about the environment.

The paper is organized as follows: Section 2 describes the GSOEP data and the methods used for the regression analysis; Section 3 gives estimation results for the analysis of life satisfaction and people's concerns about environmental protection. Section 4 concludes.

2. Data and Methods

2.1. Data

The GSOEP is a household panel study that started its first wave in 1984. While being multi-disciplinary, it is clearly centered on the analysis of the life course and well-being, measured by the two concepts of income and life satisfaction. The original sample size was just below 6,000 households and included slightly more than 12,000 individual respondents. The sample was enlarged several times and reached a number of 12,499 households and 22,639 adult respondents in 2006 (Wagner, Frick, and Schupp 2007).

For my regression analysis, I use data for the years 1986 and 1987 and generate a dummy variable for the incident of Chernobyl taking on the value one if the observation dates to April 26 or later and zero otherwise. Data from the year 1987 (in addition to 1986) are included to obtain enough observations after the nuclear incident. This is necessary because more than 80 percent of the yearly interviews are usually completed before the end of April.

The dependent variable in my first regression is life satisfaction in general, rated on an 11-point scale. The question on this topic in the survey is:

> "Finally, we would like to ask you about your satisfaction with your life in general. Please answer using the following scale, in which 0 means completely dissatisfied and 10 means completely satisfied. How satisfied are you at present with your life as a whole?"

The mean value of this life satisfaction measure in the sample is 7.23; in the subsample before the Chernobyl incident it is 7.32; in the subsample after the Chernobyl incident it is 7.16.

In a further estimation, I use a binary dependent variable indicating if a respondent reported being very worried about environmental protection. The question in the survey, which appears in the context of questions about other particular worries, is:

> "Are you worried about the protection of the natural environment?"

The potential answers are "very worried", "slightly worried", or "not worried". I code a binary variable as one if the respondent reported being very worried about environmental protection and zero if he/she reported being slightly or not worried about environmental protection.

The probability of this variable being one in my sample is 47 percent; in the subsample before the Chernobyl incident it is 39 percent; and in the subsample after the Chernobyl incident it is 53 percent.

To control for confounding factors, I include a number of socio-economic variables that are common in a life satisfaction context.[1] These control variables are sex, age, age squared, nationality, the logarithm of the net household income[2], marital status, number of children, employment status, educational degree, disability, and a dummy if a person in need of long-term care lives in the respondent's household. Descriptive statistics are given in Tables A1 to A3 in the appendix.

2.2. Method

For the life satisfaction estimation I use an Ordinary Least Squares (OLS) regression, interpreting the life satisfaction variable as a cardinal scale and comparable across

[1] See, e.g., Clark and Oswald 1994, Frijters, Hasken-DeNew, and Shields 2004a and 2004b, Winkelmann 2005, Layard, Mayraz, and Nickell 2007; for a review of the life satisfaction literature see, e.g,, Easterlin 2001, Frey and Stutzer 2002, Kahneman et al. 2006.
[2] In DM and inflation-adjusted on the 1986 level.

respondents.[3] For the estimation of the binary environmental worries variable, I use a logit model, estimated by common maximum likelihood techniques (e.g., Greene 2003, ch. 17 and 21, Cameron and Trivedi 2005, ch. 5 and 14).

3. Results

The first two columns of Table 1 give the results of an OLS regression of life satisfaction on the Chernobyl dummy variable and a number of socio-economic control variables (described above). One observes that life satisfaction declined on average by 0.15 points after the nuclear catastrophe. This corresponds to a decrease of 2.1 percent for the average respondent reporting a life satisfaction value of 7.23.

The coefficients of most control variables are significant and show the same sign as in most previous life satisfaction studies.[4] The conformity of these results with previous findings points to their validity. Hence, the Chernobyl effect should be meaningful as well.

To look at the evolution of life satisfaction in the years 1986 and 1987 in more detail, I introduce monthly time dummies to the model in substitution for the Chernobyl dummy variable. Results for this second specification are shown in the last two columns of Table1.

It was not possible to include every month as a dummy variable in the model since interviews were not conducted in each month. Unavailable months are November and December 1986 as well as August and October 1987.[5] Other monthly dummies are removed from the specification because there were very few observations available; these are January, September, and October 1986 as well as September, November, and December 1987. April 1986 serves as reference category in this set of time dummies.[6]

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[3] The methodologically correct method to use for an 11-point life satisfaction scale would be ordered logit or ordered probit. However, Frey and Stutzer (2000) as well as Ferrer-i-Carbonell and Frijters (2004) have shown that using ordinary least squares regression leads to negligible differences in results and is also much more convenient for interpretation.

[4] Positive effects are identified here for the coefficients of income and for being married and living together (while the reference category is living alone). Negative effects are found for being male, living in a household with a person in need of long-term care, being disabled, being separated, divorced, or widowed, and for having children. The status of being in part-time employment, in (involuntary) unemployment, in military or civilian service (compared to being employed full-time) all have negative effects. The same is true for people not having completed any vocational degree (compared to having any vocational or higher educational degree). The negative sign of the age coefficient combined with the positive sign of the coefficient related to age squared point to a U-shaped age effect on life satisfaction. This phenomenon has been analyzed recently by Easterlin (2006), Blanchflower and Oswald (2007), as well as Clark (2007).

[5] See Table A3 in the appendix, where frequencies of monthly observations are given.

[6] The dummy variable for April 1986 is coded as one only if the interview took place between April 1 and 25. For interviews that took place between April 26 and 30, the one is delayed to the May 1986 dummy.

Table 1: The nuclear incident in Chernobyl on April 26, 1986 and life satisfaction: Results of an OLS regression with robust standard errors

		(1)		(2)	
	Variable	b	s.e.	b	s.e.
Monthly time dummies, reference category is April 1986 (without April 26-30, 1986)	Feb '86			1.229***	0.295
	Mar '86			0.027	0.049
	May '86 (incl. April 26-30, 1986)			0.030	0.069
	Jun '86			0.081	0.111
	Jul '86			0.187	0.225
	Aug '86			-0.159	0.408
	Jan '87			-1.539	1.168
	Feb '87			-0.048	0.066
	Mar '87			-0.189***	0.047
	Apr '87			-0.148**	0.069
	May '87			-0.121	0.106
	Jun '87			-0.299*	0.173
	Jul '87			-1.629***	0.558
	Chernobyl (Dummy = 1 after April 25,1986)	-0.152***	0.029		
	Male	-0.081**	0.035	-0.082**	0.035
	Age	-0.036***	0.006	-0.035***	0.006
	Age_squared	0.001***	0.000	0.001***	0.000
	Non-German nationality	0.043	0.039	0.037	0.041
	Log of monthly net household income	0.372***	0.033	0.381***	0.033
	Person in need of long-term care in the hh	-1.351***	0.098	-1.344***	0.097
	Disabled	-1.007***	0.033	-1.006***	0.033
Marital status (reference category: lone)	Married and living together	0.167***	0.054	0.161***	0.054
	Married and living separated	-0.782***	0.164	-0.801***	0.163
	Divorced	-0.303***	0.089	-0.309***	0.089
	Widowed	-0.167*	0.089	-0.176**	0.089
Number of children (reference category: no children)	1 child in household (age 0-15)	-0.115***	0.041	-0.112***	0.041
	2 children in household (age 0-15)	-0.039	0.048	-0.031	0.048
	3 or more children in household (age 0-15)	-0.221***	0.076	-0.212***	0.076
Employment status (reference category: full-time employed)	Part-time employed	-0.135**	0.061	-0.135**	0.061
	In education[a]	-0.032	0.069	-0.030	0.069
	Marginally[b] or not regularly employed	-0.093	0.104	-0.095	0.104
	(Voluntarily) not employed	-0.017	0.047	-0.018	0.047
	In military or civilian service	-0.557***	0.194	-0.537***	0.197
	Registered as unemployed	-1.098***	0.095	-1.093***	0.095
Educational degree (reference category: vocational degree[c])	College/university degree[d]	0.024	0.055	0.017	0.055
	No vocational degree	-0.096***	0.034	-0.098***	0.034
	_cons	5.282***	0.295	5.185***	0.298
Number of obs		16,355		16,347	
F(23, 16331)		80.19		54.38	
Prob > F		0.000		0.000	
R-squared		0.1199		0.1223	
Root MSE		1.805		1.804	

[a] This refers to being in vocational training, in higher education, in voluntary service, or doing an internship.
[b] "Marginal employment" *(geringfügige Beschäftigung)* in Germany means working a low number of hours and having earnings not or only partially subject to social security contributions.
[c] This category includes degrees from *Lehre, Berufsfachschule, Schule für Gesundheitswesen, Fachschule, Beamtenausbildung*, and other vocational degrees.
[d] This category includes degrees from a University, *Fachhochschule*, *Technische Hochschule (TH)*, and equivalent degrees from other countries.
* Statistically significant at the level $\alpha = 10\%$.
** Significant at the level $\alpha = 5\%$.
*** Significant at the level $\alpha = 1\%$.
Source: Data from the German Socio-Economic Panel Study, waves 1986 and 1987, author's calculations.

Substituting the Chernobyl dummy by monthly time dummies does not change the coefficients of the controls visibly. In this respect, they are robust.

Most coefficients of the monthly dummies for the year 1986 are not significant. An exception is that of February 1986, but a quick look at Table A3 in the appendix reveals that there are only nine observations dating to this month. Thus, in this case, the coefficient should be considered with caution. A remarkable finding is the lack of any negative effect in the months immediately after the catastrophe (especially in May 1986, there are certainly enough observations). However, life satisfaction was negatively affected almost one year later, in March and April 1987. The average satisfaction level declined by 0.19 and 0.15 points respectively on the life satisfaction score. It is hard to say whether this effect is really due solely to the nuclear catastrophe or whether it might be caused by some other event or trend during this period. A downward sloping business cycle, however, is not a reasonable explanation, as the next recession took place only in 1993. Therefore, one could argue that this is indeed an effect of the Chernobyl accident, and that people realized only over the course of the time and through the public debate how the incident would affect their personal lives. Unfortunately, it is not possible to determine the exact point in time in which life satisfaction declined because few interviews were conducted during the winter months.

To analyze how quickly people realized the severity of the catastrophe, I will look at the impact of the Chernobyl incident on people's worries about environmental protection in the next step. For this purpose, I estimate a logit model using as dependent a binary variable taking on the value of one if a respondent reported being very worried about environmental protection. A similar range of control variables as above is included in the model.[7] The results are given for a model with a single Chernobyl dummy (first and second column of Table 2) and a further model containing monthly time dummies (third and fourth column of Table 2).

First a note on the resulting marginal effects related to the control variables: Men are less concerned about environmental issues than Women and Non-Germans are also less concerned than Germans. Especially in the 1980s, the sense for environmental issues was in Germany much more pronounced than in other countries.

[7] However, the controls "disabled" and the dummy variable indicating whether a person in need of long-term care lives in the respondent's household are removed from the model because they are judged to be of little importance in the context of environmental worries. Indeed, when included in the analysis, the related coefficients are statistically not significant and the coefficients of the other regressors do not change much.

Furthermore, the higher people are educated, the more they worry about the natural environment. This is suggested by the positive marginal effect related to the variable of having a university/college degree and the negative effect related to the variable of having no vocational degree.

Respondents in part-time employment, in education, in marginal employment, and unemployed are significantly more worried about environmental protection than full-time employed respondents. The reason could be that all these categories of people–as they do not work the whole day–have more time to care about environmental issues. In contrast, people who are voluntarily not employed seem not being more concerned about the environment than full-time workers. This could be due to the fact that those people are busy with other activities than employment (e.g. child care). However, one could expect that parents are more concerned about the environment than people without children as children's health was particularly endangered, especially when playing outside. However my results suggest that parents are significantly less worried about the environment, and the effects (in absolute values) even increase with the number of children. This supports my hypothesis that parents do not have much time left to care about "invisible" things–at least not at that time where environmental protection were less present in the public debate than it is today.

Back to the Chernobyl question, I want to emphasize that the coefficient of the Chernobyl dummy is highly significant and the probability of a respondent reporting being very worried about the environment increased by about 16 percentage points after April 26, 1986.

The regression on monthly dummies shows that in the two months after the incident, the probability of a respondent reporting being very worried is nine percentage points higher than in the month before the incident. The effects of the following three months are not significant, which is likely due to the small sample size interviewed in these months. Only 90 interviews were conducted in July 1986, 20 in August 1986, and three in January 1987[8]. In the months February, March, and April 1987, the effects are again highly significant (even on the 0.1% level). The probabilities of being very concerned about the environment in these months is 14 (February), 16 (March), and seven (April) percentage points higher than in April 1986. In the following month, May 1987, the probability is still eight percentage points higher and the effect is still significant on a 5% level. For the months June and July 1987, there are only 111 and 19 observations respectively, with the latter nevertheless showing a significant effect on environmental concerns.

[8] See Table A2 in the appendix for the number of observations in each month.

Table 2: The nuclear incident in Chernobyl on April 26, 1986, and worries about the environmental protection: Results of a logit estimation[a]

		(1)		(2)	
	Variable	m.e.	s.e.	m.e	s.e.
Monthly time dummies, reference category is April 1986 (without April 26-30, 1986)	Feb '86			-0.243*	0.143
	Mar '86			-0.040***	0.014
	May '86 (incl. April 26-30, 1986)			0.088***	0.019
	Jun '86			0.093***	0.031
	Jul '86			0.028	0.057
	Aug '86			0.043	0.115
	Jan '87			0.215	0.264
	Feb '87			0.143***	0.018
	Mar '87			0.154***	0.013
	Apr '87			0.070***	0.020
	May '87			0.083**	0.033
	Jun '87			0.050	0.051
	Jul '87			0.299***	0.095
	Chernobyl (Dummy = 1 after April 25,1986)	0.157***	0.008		
	Male	-0.031***	0.010	-0.031***	0.010
	Age	0.002	0.002	0.002	0.002
	Age_squared	0.000***	0.000	0.000***	0.000
	Non-German nationality	-0.158***	0.010	-0.150***	0.011
	Log of monthly net household income	-0.014	0.009	-0.016*	0.009
Marital status (reference category: lone)	Married and living together	-0.011	0.016	-0.010	0.016
	Married and living separated	-0.104***	0.039	-0.102***	0.039
	Divorced	0.016	0.025	0.016	0.025
	Widowed	0.010	0.024	0.012	0.024
Number of children (reference category: no children)	1 child in household (age 0-15)	-0.026**	0.012	-0.026**	0.012
	2 children in household (age 0-15)	-0.040***	0.014	-0.041***	0.014
	3 or more children in household (age 0-15)	-0.070***	0.020	-0.071***	0.020
Employment status (reference category: full-time employed)	Part-time employed	0.029*	0.018	0.029	0.018
	In education[a]	0.145***	0.019	0.143***	0.019
	Marginally[b] or not regularly employed	0.058**	0.029	0.057**	0.029
	(Voluntarily) not employed	0.004	0.013	0.003	0.013
	In military or civilian service	0.067	0.059	0.063	0.060
	Registered as unemployed	0.044**	0.021	0.042**	0.021
Educational degree (reference category: vocational degree[c])	College/university degree[d]	0.116***	0.016	0.119***	0.016
	No vocational degree	-0.074***	0.010	-0.073***	0.010
Number of obs		16,355		16,347	
LR chi2(21)		1,171.3		1230.24	
Prob > chi2		0.000		0.000	
Pseudo R2		0.052		0.0544	
Log likelihood		-10,728		-10,693	

[a] The binary dependent variable takes on the value of one if the respondent reported being very worried, and the value of zero if he/she reported not being worried or only slightly worried about environmental protection. The figures shown in the first and second column are marginal effects at the mean.

[b] This refers to being in vocational training, in higher education, in voluntary service, or doing an internship.

[c] "Marginal employment" in Germany *(geringfügige Beschäftigung)* means working a low number of hours and having earnings not or only partially subject to social security contributions.

[d] This category includes degrees from *Lehre, Berufsfachschule, Schule für Gesundheitswesen, Fachschule, Beamtenausbildung,* and other vocational degrees.

[e] This category includes degrees from a University, *Fachhochschule*, *Technische Hochschule (TH)*, and equivalent degrees from other countries.

* Statistically significant at the level $\alpha = 10\%$.

** Significant at the level $\alpha = 5\%$.

*** Significant at the level $\alpha = 1\%$.

Source: Data from the German Socio-Economic Panel Study, waves 1986 and 1987, author's calculations.

One can conclude that worries about the environment increased immediately after the nuclear incident and did not attenuate after several months but rather increased further over the course of time.

The impact of the catastrophe on worries about the environment was much more pronounced than on general life satisfaction. But since this effect grew over the course of the time (reaching a peak in 1987), it is reasonable to conclude that the negative effect on life satisfaction in 1987 was also caused by the catastrophe.

4. Conclusion

In this paper, I have demonstrated the power of the German Socio-Economic Panel (GSOEP) study which—due to its large sample size and the fact that interviews are spread over a period of several months—allows the analysis of critical large-scale events. Because the exact date of each interview is provided in the standard GSOEP dataset, the researcher is able to analyze abrupt events on a cross-section and also observe long-term effects exploiting the longitudinal character of the data. This feature has been shown in this paper by means of a regression analysis of the association between the nuclear incident in Chernobyl on April 26, 1986, and people's life satisfaction and worries about the environment.

Life satisfaction declined by 0.15 points or 2.1 percent for the average respondent following the nuclear catastrophe. However, this effect was due mainly to decreased life satisfaction in 1987 compared to the year 1986. The more visible effect is the sharp increase in worries about the natural environment. The incident appears to be responsible for a nine percentage point increase in the probability of being "very worried about environmental protection" in May 1986 and by even 14 and 15 percentage points in February and March 1987, respectively. The growing impact in the respondents' minds over the course of time could be an explanation for the delayed negative effect on life satisfaction.

Finally, while this analysis uses fairly old data, it is clear that more recent waves of the GSOEP are at least as powerful or even more powerful, because the sample size has expanded progressively over the years.

Appendix

Table A1: Descriptive Statistics: Absolute and relative frequencies of the dummy variables included in the regression models

	Variable	Absolute frequency	Relative frequency
	Being very worried about the environmental protection	7,746	47.4%
	Chernobyl (Dummy = 1 from April 26,1986)	9,622	58.8%
	Male	8,078	49.4%
	Non-German nationality	4,059	24.8%
	Person in need of long-term care living in the hh	639	3.9%
	Disabled	6,049	37.0%
Marital status	Married and living together	11,177	68.3%
	Married and living separated	185	1.1%
	Lone	3,286	20.1%
	Divorced	677	4.1%
	Widowed	1,030	6.3%
Number of children	1 child in household (age 0-15)	3,189	19.5%
	2 children in household (age 0-15)	2,269	13.9%
	3 or more children in household (age 0-15)	867	5.3%
Employment status	Full-time employed	7,945	48.6%
	Part-time employed	1,097	6.7%
	In education[a]	1,211	7.4%
	Marginally[b] or not regularly employed	350	2.1%
	In military or civilian service	84	0.5%
	(Voluntarily) not employed	5,074	31.0%
	Registered as unemployed	678	4.1%
Educational degree	College/university degree[c]	1,172	7.2%
	Vocational degree[d]	8,730	53.4%
	No vocational degree	6,453	39.5%
	Number of obs = 16,355		

[a] This refers to being in vocational training, in higher education, in voluntary service, or doing an internship.
[b] "Marginal employment" in Germany (*geringfügige Beschäftigung*) means working a low number of hours and having earnings not or only partially subject to social security contributions.
[c] This category includes degrees from *Lehre, Berufsfachschule, Schule Gesundheitswesen, Fachschule, Beamtenausbildung,* and other vocational degrees.
[d] This category includes degrees from a University, *Fachhochschule*, *Technische Hochschule (TH)*, and equivalent degrees from other countries.
Source: Data from the German Socio-Economic Panel Study, waves 1986 and 1987, author's calculation.

Table A2: Descriptive Statistics for metric variables included in the regression models

Variable	Mean	Std. Dev.	Min	Max
Life satisfaction	7.23	1.92	0	10
Monthly net household income[a]	3,285	2,579	50	96,207
Age	43.2	16.4	16	94
Number of obs = 16,355				

[a] In DM and inflation-adjusted on the 1986 level.
Source: Data from the German Socio-Economic Panel Study, waves 1986 and 1987, author's calculation.

Table A3: Descriptive Statistics: Absolute and relative frequencies of observations in each month

Month	Absolute frequency	Relative frequency
Jan '86	1	0.0%
Feb '86	9	0.1%
Mar '86	4,542	27.8%
Apr '86	2,181	13.3%
May '86 (incl. April 26-30, 1986)	1,052	6.4%
Jun '86	306	1.9%
Jul '86	86	0.5%
Aug '86	20	0.1%
Sep '86	1	0.0%
Oct '86	2	0.0%
Nov '86	0	0.0%
Dec '86	0	0.0%
Jan '87	3	0.0%
Feb '87	1,317	8.1%
Mar '87	5,394	33.0%
Apr '87	1,030	6.3%
May '87	278	1.7%
Jun '87	110	0.7%
Jul '87	19	0.1%
Aug '87	0	0.0%
Sep '87	1	0.0%
Oct '87	0	0.0%
Nov '87	1	0.0%
Dec '87	2	0.0%
Number of obs = 16,355		

Source: Data from the German Socio-Economic Panel Study, waves 1986 and 1987, author's calculation.

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